



## FEDERAL COMMUNICATIONS COMMISSION

### 47 CFR Parts 15 and 74

[ET Docket No. 21-115, RM-11821; FCC 21-46; FR ID 26756]

### Wireless Microphones in the TV Bands, 600 MHz Guard Band, 600 MHz Duplex Gap, and the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz Bands

**AGENCY:** Federal Communications Commission.

**ACTION:** Proposed rule.

**SUMMARY:** In this document, the Commission aims to enhance the spectral efficiency of wireless microphones by permitting a recently developed type of wireless microphone system, termed herein as a Wireless Multi-Channel Audio System (WMAS), to operate in certain frequency bands. This emerging technology would enable more wireless microphones to operate in the spectrum available for wireless microphone operations, and thus advances an important Commission goal of promoting efficient spectrum use. The Commission proposes to revise the applicable technical rules for operation of low-power auxiliary station (LPAS) devices to permit WMAS to operate in the broadcast television (TV) bands and other LPAS frequency bands on a licensed basis. The Commission also proposes to update the existing LPAS and wireless microphone rules to reflect the end of the post-Incentive auction transition period and update references to international wireless microphone standards.

**DATES:** Comments are due [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. Reply comments are due [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**FOR FURTHER INFORMATION CONTACT:** Hugh Van Tuyl, Office of Engineering and Technology, 202-418-7506, [Hugh.VanTuyl@fcc.gov](mailto:Hugh.VanTuyl@fcc.gov).

**SUPPLEMENTARY INFORMATION:** This is a summary of the Commission's Notice of Proposed Rulemaking, ET Docket No. 21-115, RM-11821, FCC 21-46, adopted and released April 22, 2021. The full text of this document is available for inspection and copying during normal business hours in the FCC Reference Center (Room CY-A257), 445 12th Street SW., Washington, DC 20554. The full text may

also be downloaded at: <https://www.fcc.gov/document/fcc-looks-open-door-new-wireless-microphone-technologies-0>. People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an email to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

## **Synopsis**

1. In this Notice of Proposed Rulemaking (NPRM), the Commission proposes to revise the applicable technical rules for operation of part 74 low-power auxiliary station (LPAS) devices to permit a recently developed type of wireless microphone system, termed herein as a Wireless Multi-Channel Audio System (WMAS), to operate in the broadcast television (TV) bands and other part 74 LPAS frequency bands on a licensed basis. This emerging technology would enable more wireless microphones to operate in the spectrum available for wireless microphone operations, and thus advances an important Commission goal of promoting efficient spectrum use. The Commission propose and seek comment on technical rules for WMAS operations under our part 74 LPAS rules for licensed wireless microphone operations as well as the particular frequency bands in which WMAS wireless microphones would be permitted to operate. The Commission also seeks comment on whether to permit WMAS under the part 15 rules that allow unlicensed wireless microphone operations in the TV bands, the 600 MHz guard band, and 600 MHz duplex gap. The Commission also proposes to update our existing part 74 LPAS and part 15 technical rules for wireless microphones, which already rely on certain European Telecommunications Standards Institute (ETSI) standards, to incorporate the latest version of that standard where appropriate. Finally, the Commission proposes to update the wireless microphone rules to reflect the end of the post-Incentive auction transition period. Its aim in this proceeding is to enhance the spectral efficiency of wireless microphone use. The Commission does not intend to alter the existing spectrum rights – or expectations regarding access and availability of spectrum – vis-à-vis all the various authorized users, whether broadcast licensees, white space device users, the wireless microphone users themselves, or others, that share frequency bands with wireless microphones.

2. Background. Many types of users employ wireless microphones in a variety of settings including theaters and music venues, film studios, conventions, corporate events, houses of worship, and

Internet webcasts. Wireless microphone operations range from professional uses, with the need for numerous high-performance microphones, to an individual consumer's use of a handheld microphone at a conference or in a karaoke bar. These devices are authorized for operations both on a licensed and unlicensed basis, depending on the frequency band. Most licensed wireless microphones operate under the part 74 rules for low power auxiliary stations (LPAS) on a secondary basis. Under those rules, they can operate on unused spectrum in the TV bands (both VHF and UHF), a 4-megahertz portion of the 600 MHz duplex gap, certain frequencies in the 900 MHz band, the 1435-1525 MHz band (shared with federal Aeronautical Mobile Telemetry (AMT) service), and portions of the 7 GHz band. Entities eligible for part 74 licenses include broadcast station licensees and networks, certain cable television operators, motion picture/TV producers, and professional sound companies and venue operators that routinely use 50 or more wireless microphones. Unlicensed wireless microphones also operate in certain bands under the part 15 rules – including the VHF and UHF-TV bands where they generally share the same basic technology used by licensed LPAS wireless microphones (although unlicensed operations are limited to lower, more restrictive power levels than licensed operations).

3. Historically and currently, most wireless microphones – both licensed and unlicensed -- operate on unused spectrum in the TV bands where they share use of unused TV band spectrum with unlicensed white space devices. The spectrum available for these devices has decreased in recent years as a result of the Commission's actions that repurposed some portions of the TV bands for wireless services and repacked the TV bands. In 2015 and 2017, the Commission took several actions focused either on promoting more efficient use of the spectrum by both licensed and unlicensed wireless microphone operations in the repacked TV bands, 600 MHz guard band, and 600 MHz duplex gap, or finding spectrum in additional frequency bands that could be used to accommodate licensed wireless microphone operations.

4. Petition for rulemaking. On August 17, 2018, Sennheiser Electronic Corporation (Sennheiser) filed a petition for rulemaking requesting that the Commission modify the part 74 LPAS rules for licensed wireless microphones. Specifically, it requests that the Commission define a new class of wireless microphone, which it terms a "Wireless Multi-Channel Audio System (WMAS)," that digitally combines the signals of multiple LPAS wireless microphones into a wider channel than currently

permitted in the TV bands or other LPAS frequency bands. Sennheiser states that other wireless microphone manufacturers are developing similar systems. Sennheiser specifically requests that such systems be permitted to operate with a maximum channel bandwidth of 6 megahertz, the same size as an entire TV channel, rather than 200 kilohertz channels as the rules currently allow for LPAS devices in the TV bands, and that they be permitted to operate not only in the TV bands, but also in the 600 MHz duplex gap and in the 941.5-944 MHz, 944-952 MHz, and 1435-1525 MHz bands that also are available for licensed LPAS wireless microphone operations. Sennheiser explains that, rather than placing each wireless microphone on its own separate frequency, as under current technical rule specifications, WMAS digitally combines the signals from multiple devices into a 6-megahertz channel, eliminating intermodulation and permitting denser use of the spectrum while lowering the average power spectral density across the channel. Sennheiser notes that a potential downside of authorizing WMAS is the possibility that an operator connects too few devices on the wider channel to realize WMAS's potential for improved spectrum efficiency, and proposes rules that would require WMAS devices to operate a minimum of 12 wireless microphones in a 6-megahertz channel. Sennheiser asserts that this technology will improve spectrum efficiency by allowing an increased number of devices to operate in a 6-megahertz channel and thus help to counter a severe spectrum shortage for wireless microphones.

5. The Commission sought public comment on the Sennheiser petition. Two wireless microphone manufacturers, Alteros and Shure, filed comments, as did Microsoft, whose concern focuses on white space device operations. Sennheiser, Microsoft, and the Aerospace and Flight Test Radio Coordinating Council (AFTRCC), which must approve any LPAS operations in the 1435-1525 MHz band, filed reply comments. Commenters generally support increasing the spectral efficiency of wireless microphones, but raise some potential concerns about Sennheiser's proposals. In particular, Alteros and Microsoft express concerns that WMAS not adversely affect the coexistence of wireless microphones systems made by different manufacturers and request that the Commission not adopt rule changes that benefit only a single manufacturer. Alteros, Shure, and Microsoft argue that the minimum number of wireless microphones that should be required in a 6-megahertz band should be higher than the 12 suggested by Sennheiser. In addition, Microsoft expresses concern about the potential impact that permitting WMAS operations may have on white space device operations. While Microsoft does not

oppose using WMAS on TV band frequencies and in the 4-megahertz portion of the 600 MHz duplex gap in which licensed LPAS wireless microphones are authorized, it opposes permitting WMAS operations in the unlicensed 6-megahertz portion of the 600 MHz duplex gap, which it views as critical for white space devices because this spectrum is available for white space device operations throughout the United States. Alteros asks that any rule changes apply to all part 74 LPAS frequency bands, including the expanded 900 MHz bands and the 1435-1525 MHz band. In its initial comments, Shure suggests that the Commission consider permitting WMAS in only certain bands as a preliminary matter, and in particular consider not permitting WMAS operations in the 1435-1525 MHz band initially due to concerns that specific equipment authentication and software-based controls for coordination with AFTRCC in that band are under development, but in more recent filings Shure now indicates its support for permitting WMAS in all frequency bands available for licensed wireless microphone operations under the part 74 LPAS rules – including the TV bands, the 600 MHz duplex gap, and the 900 MHz bands, the 1435-1525 MHz band, and the 7 GHz band. AFTRCC states that it has no objection to the petition as long as the current coordination and authentication requirements for the 1435-1525 MHz band are not modified. Shure and Microsoft also generally request that the Commission examine the compatibility of WMAS with other systems or operations in the frequency bands in which WMAS would operate.

6. In its most recent *ex parte* filings, submitted in December 2020 and January 2021, Shure recommends that the Commission update the technical rules consistent with the updated 2017 version of the ETSI standard concerning wireless microphones. Shure notes that this latest version already permits certain types of WMAS devices in Europe and thus would allow the United States to harmonize its wireless microphone rules and promote greater spectral efficiency for wireless microphone operations. It also notes that updating the rules to reflect the newest version of the ETSI standard would allow the Commission to reference a single document for both the single carrier emission limits as well as the limits for WMAS.

7. Discussion. The Commission proposes to amend the part 74 LPAS technical rules to permit the use of WMAS in most of the LPAS frequency bands where wireless microphones are currently permitted to operate. If adopted, WMAS devices would be a new type of wireless microphone system that, by using wider channelization than currently is permitted for wireless microphones under part 74

along with a more efficient operating protocol, would enable more microphones to be deployed within the same amount of spectrum. Three wireless microphone manufacturers – Sennheiser, Alteros, and Shure – request that the Commission permit WMAS in certain frequency bands, and Microsoft and AFTRCC also generally support WMAS provided that their concerns can be addressed. Specifically, the Commission proposes and seeks comment on the definition of WMAS, the frequency bands in which WMAS would be permitted, and the appropriate technical requirements (e.g., spectral efficiency, channel bandwidth, maximum power, and emission masks) that would govern operation of these systems. As part of its proposal, the Commission specifically proposes applying technical rules for WMAS consistent with the recently updated ETSI standard for WMAS. The Commission also takes this opportunity to propose updating its existing technical rules for currently authorized part 74 LPAS wireless microphones, which already rely on certain ETSI standards, in order to incorporate the applicable portions of the recently updated ETSI standard. In addition, the Commission also seeks comment on whether the Commission should revise the part 15 technical rules for unlicensed wireless microphone devices that operate in the TV bands, the 600 MHz guard band, and the 600 MHz duplex gap to permit WMAS operations for those devices in some or all of those frequency bands, and whether the Commission should revise the part 15 wireless microphone rules to require use of an updated ETSI standard. Finally, the Commission proposes and seeks comment on updating its rules to reflect the end of the post-Incentive Auction transition.

8. Revisions to the part 74 LPAS Rules to Authorize WMAS. In its petition, Sennheiser proposes that the Commission use the term “Wireless Multi-Channel Audio System” for this new type of wireless microphone device, and to broadly define this system as “[a] system that digitally combines the signals of multiple low power auxiliary station devices onto one radio-frequency channel.” Shure agrees. Alteros asks that any definition not limit the system to use by a single company such as Sennheiser. The Commission notes that the most recent version of the ETSI standards uses the same name for this system, “Wireless Multi-Channel Audio System,” though it does have a slightly different definition, namely a “wireless audio transmission system[] using broadband transmission technique for microphone and in-ear monitor systems, and other multichannel audio [Programme Making and Special Events] use.”

9. Discussion. The Commission proposes to adopt the terminology proposed by Sennheiser, as well as the definition it proposes. The Commission seeks comment on this proposed designation and

definition. Is it appropriate for the type of wireless microphone system the Commission proposes to permit? Would a different name or definition be more appropriate? If so, how should the proposed name or definition be modified to provide more accuracy or a better description of WMAS?

10. Frequency Bands of Operation. In its petition, Sennheiser specifically requests that WMAS be permitted to operate in the TV bands, in the 600 MHz duplex gap, and in the 941.5-944 MHz, 944-952 MHz, and 1435-1525 MHz bands that also are available for licensed LPAS wireless microphone operations. Alteros asks that any WMAS apply to all part 74 LPAS frequency bands, including the expanded 900 MHz bands and the 1435-1525 MHz band, while Shure similarly supports permitting WMAS in all frequency bands available for licensed wireless microphone operations under the part 74 LPAS rules – including the TV bands (VHF and UHF), the 600 MHz duplex gap, the 900 MHz bands, the 1435-1525 MHz band, and the 7 GHz band.

11. Discussion. The Commission proposes to allow WMAS to operate in most of the bands where part 74 wireless microphones are permitted to operate, including the VHF-TV bands (54-72 MHz, 76-88 MHz and 174-216 MHz), the UHF-TV band (470-608 MHz), the 653-657 MHz segment of the 600 MHz duplex gap, and the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands. These are all of the frequency bands available for LPAS operations in which the Commission believes that wireless microphones using a wider channelization system are technically feasible and thus could enable more efficient use of the limited spectrum available for wireless microphone operations. The Commission is not, however, proposing to allow WMAS operation in the 26.100-26.480 MHz, 161.625-161.775 MHz, 450.000-451.000 MHz and 455.000-456.000 MHz bands because the Commission believes that the available spectrum (1 megahertz or less in each band) make them less suited for WMAS operation.

12. The Commission seeks comment on this proposal. Are all of the bands where the Commission has proposed to permit WMAS operation suitable for such operation? The Commission's goal is to promote more efficient use of spectrum for LPAS operations and it is mindful that not all LPAS operations would use WMAS and that other operations share the affected frequency bands. Thus, the Commission seeks to permit WMAS while not adversely affecting these other operations. Are there special considerations that should be taken into account for any of the bands proposed for WMAS? In the

TV bands wireless microphones are secondary to broadcast TV stations and share use of spectrum unused by broadcasters with white space devices. Wireless microphones are secondary to both federal and non-federal systems operating in the 941.5-944 MHz band and the 1435-1525 MHz band and are secondary to broadcast or other licensed services in the 944-952 MHz and portions of the 952-960 MHz, the 6875-6900 MHz and the 7100-7125 MHz bands, and wireless microphone operations must be coordinated under specified coordination requirements. Would WMAS operations in any of the proposed bands raise concerns about adversely affecting incumbent systems or authorized users? For instance, when coordinating WMAS operations, are there any additional interference mitigation techniques or technologies that would be necessary or can be used to help prevent harmful in-band interference? Are specific rules needed to reflect that all uses continue to be available and that users have flexibility to operate equipment and devices that best meet their needs? In light of recent changes to the 6 GHz band, the Commission invites specific comment on WMAS operation in the 6875-6900 MHz and the 7100-7125 MHz bands. To what extent are LPAS operations making use of these bands? If the Commission authorizes WMAS generally, how might this affect use of these bands by part 74 wireless microphone operations? Should WMAS not be authorized in these bands, or should part 74 wireless microphones no longer be permitted to operate in these bands altogether, considering the recent changes and expected future usage of this spectrum?

13. Are there any other LPAS bands where the Commission should permit WMAS to operate? Would it be feasible or appropriate to allow WMAS operation in any of the bands that the Commission has proposed to exclude? Is there a minimum amount of bandwidth necessary for WMAS to operate? How does the amount of available channel bandwidth affect efficiency? Does the number of microphones that can be supported increase linearly with increasing spectrum or is there a different relationship? Finally, the Commission asks that commenters discuss the costs and benefits associated with their recommended approach regarding the authorization of WMAS in particular frequency bands. In particular, the Commission seeks information and data about operations in these bands and any other bands that commenters suggest for WMAS use. This information and data should include details regarding current wireless microphone usage, such as quantitative measures describing how many microphones are used per channel at various locations, how wireless microphones are used and the types



of users as well as how these measures, uses and users would change if WMAS were used instead of currently authorized wireless microphones that operate using narrower bandwidths.

14. Technical Requirements. In this section the Commission proposes and seeks comment on technical requirements for WMAS devices. Because the current part 74 rules for wireless microphones are based on the use of narrower bandwidths than would be used for WMAS operation, the Commission will need to specify appropriate and possibly different technical requirements for these wider bandwidth systems for wireless microphones, including output power limits and emission masks.

15. Bandwidth. The part 74 rules limit wireless microphones operating in the TV bands and 600 MHz duplex gap to a 200 kilohertz maximum bandwidth. Wireless microphones operating in the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands do not have bandwidth limits specified in the part 74 rules, but are required to meet the emission masks specified in the 2011 ETSI wireless microphone standard, i.e., ETSI EN 300 422-1 v1.4.2 (2011-08) [“EN 300 422-1 (2011)”], which precludes the use of wide bandwidths, e.g., 1 megahertz or greater. Accordingly, the Commission’s existing rules would preclude WMAS operations as proposed by Sennheiser (i.e., use of a 6-megahertz channel for the wireless microphone system). The Commission notes that the most recent version of the ETSI standard, established in 2017, permits WMAS to operate using wider channels up to 20 megahertz.

16. Discussion. The Commission proposes to allow WMAS devices to use a 6-megahertz maximum bandwidth as suggested by Sennheiser and Shure, subject to any technical or other limitations inherent to the particular frequency band. A 6-megahertz channel corresponds to the size of channels in the TV bands where many part 74 wireless microphones currently operate. The Commission also notes that no commenter suggested a larger channel size for WMAS. Under the Commission’s proposal, the bandwidth of a WMAS device could be smaller than 6 megahertz, either by system design or as needed to comply with the amount of spectrum available under the Commission’s rules. For instance, the bandwidth of a WMAS device for licensed wireless microphone operations in the 4 megahertz of spectrum available for LPAS operations in the 600 MHz duplex gap (653-657 MHz) would be limited to 4 megahertz, and the amount of spectrum available in each of the 952.850-956.250 MHz and 956.45-959.85 MHz bands is less than 6 megahertz. The Commission further proposes that for WMAS devices

operating in the TV bands, the 6 megahertz (or less) WMAS channel must fall entirely within a single TV channel (2-36) that is available for part 74 wireless microphones in accordance with the separation requirements under § 74.802(b). This requirement will prevent a WMAS device from occupying portions of two unused TV channels simultaneously, potentially excluding other uses that require a full 6-megahertz channel, such as unlicensed white space devices or other wireless microphone operations using WMAS.

17. The Commission seeks comment on these proposals. In particular, it seeks comment on whether 6 megahertz is the appropriate maximum channel size for WMAS part 74 LPAS wireless microphone devices in the TV bands and other frequency bands (apart from the smaller sized 4-megahertz portion of the 600 MHz duplex gap), or whether the Commission should allow larger channel sizes. For example, Shure notes that the 2017 ETSI standard EN 300 422-1 V2.1.2 (2017-01) [“EN 300 422-1 (2017)”] permits a channel bandwidth of up to 20 megahertz for WMAS systems. If the Commission were to allow channel sizes greater than 6 megahertz, in which bands should the Commission allow them? For instance, should a wider channel for WMAS be permitted only outside the TV bands (e.g., in the 944-952 MHz band, the 1435-1525 MHz band or the 6875-6900 MHz and 7100-7125 MHz portions of the 7 GHz band) that do not involve pre-existing 6-megahertz channels? Are 6-megahertz wide channels for WMAS appropriate in all of the bands outside the TV bands (for example in the 944-952 MHz band where other services use a channel plan consisting of 25 kHz segments)? Should WMAS operating in bands outside of the TV bands also be required to operate within the limits of a single channel as defined by the channel plans of the other services using those bands (for example in the 6875-6900 MHz band where the channel plans of other services are based on 25 megahertz channel sizes, should WMAS systems be required to fall entirely within one of the existing channels)? Should wider channels be allowed within the TV bands at locations where there are two or more contiguous unused channels available for licensed LPAS wireless microphone use?

18. In addition, the Commission seeks comment on co-existence between WMAS and other operations with which it would share the spectrum. Would wider channel bandwidths make spectrum co-existence and sharing more difficult with narrower bandwidth wireless microphones, or between WMAS devices produced by different manufacturers? Should the Commission adopt any requirements to better

enable co-existence and sharing between different types of wireless microphone systems? Would permitting channels wider than 6 megahertz for WMAS in the TV bands potentially alter the balance between licensed LPAS wireless microphone operations and white space devices that share available unused channels in the TV bands? The Commission also seeks comment on whether there should be a minimum bandwidth specified for WMAS. For example, because the Commission proposed to exclude spectrum bands where 1 megahertz or less is available for wireless microphones, should the Commission restrict WMAS to a minimum 1-megahertz bandwidth? Is there a different minimum that should be specified, or should the Commission not specify a minimum bandwidth at all? The Commission seeks comment on how specifying a minimum or maximum bandwidth may affect spectrum efficiency and the ability for systems of different types (e.g., currently authorized wireless microphones and WMAS wireless microphones) to co-exist. The Commission also seeks comment on the costs and benefits with respect to equipment cost and spectrum usage of specifying specific minimum and maximum bandwidths for WMAS.

19. Spectral Efficiency. In its petition requesting that the Commission authorize WMAS, Sennheiser notes that a potential downside is the possibility that an operator connects too few devices on the wider channel to realize WMAS's potential for improved spectrum efficiency. To ensure that users operating WMAS would use spectrum as or more efficiently than currently authorized wireless microphones (e.g., wireless microphones restricted to 200 kilohertz in the TV bands), Sennheiser proposes that operators be required to operate a minimum of 12 wireless microphones on a WMAS in a 6-megahertz channel. Alteros contends that there should be a minimum of 24 wireless microphones in a 6-megahertz channel, while Shure proposes WMAS use a minimum of 3 wireless microphones per 1-megahertz of spectrum. Microsoft states more generally that the Commission should encourage that WMAS maximize efficient use.

20. Discussion. Sennheiser, Alteros, and Shure agree that the Commission should establish spectral efficiency requirements for WMAS devices to ensure sufficient use of the spectrum by any WMAS, although they disagree on what those should be. As suggested by Shure, the Commission proposes that WMAS devices comply with a spectral efficiency requirement of at least three audio channels per megahertz (18 audio channels per 6 megahertz) to ensure that these wider bandwidth devices

do not occupy more spectrum than necessary. This proposal is consistent with ETSI's requirement that WMAS must have at least one mode that supports a minimum of three audio links per megahertz. The Commission believes that Sennheiser's suggestion of 12 channels per 6 megahertz does not represent an improvement over what is currently achievable with existing technology. The Commission is also concerned that Alteros' suggestion of 24 channels per 6 megahertz might not be achievable in some cases, such as when an operator needs to use many very high-quality audio channels. The Commission therefore proposes to require WMAS devices to operate with a minimum spectral efficiency of three audio channels per megahertz as suggested by Shure. The Commission believes that a spectral efficiency requirement specified over one megahertz may be more appropriate and more flexible than a requirement specified over the WMAS device maximum channel bandwidth because it provides an easier method to scale total power to different bandwidths, thus allowing manufacturers to produce devices in which the bandwidth could be varied as necessary based on the number of audio channels required and the spectrum available for use in any particular frequency band while also ensuring more efficient use of spectrum for wireless microphone operations.

21. The Commission seeks comment on these proposals. In particular, the Commission seeks comment on whether the proposed spectral efficiency metric is appropriate. How does this metric, which would require at least 18 wireless microphones within a 6-megahertz channel, compare to what is achievable using the types of analog and digital microphones permitted under existing rules? How should an audio channel be defined in this context? Should the metric be higher or lower, and if so why? The Commission also seeks comment on whether there are any other spectral efficiency metrics that the Commission could specify in place of, or in addition to, the number of audio channels. For example, the audio for actors in a stage production or vocalists performing a concert may need the highest quality audio while lower quality audio may be acceptable for other uses. Should a spectral efficiency requirement consider the type of audio channel, e.g., voice or high quality, in a specification of the minimum number of channels required per megahertz of spectrum? Alternatively, would a minimum data rate (e.g., X bits per second per megahertz) be more appropriate rather than tying efficiency to number of audio channels? If so, what data rate would be appropriate and over what bandwidth? Commenters should provide details regarding advantages or disadvantages of such an approach as compared to the

proposed three audio channel per megahertz efficiency requirement. How could a spectral efficiency requirement be enforced at the equipment authorization level, at the time of licensing, and/or in the field? That is, in addition to ensuring that the equipment can meet any spectral efficiency requirement during the equipment approval process, are there ways to ensure that WMAS users actually operate in accordance with any spectral efficiency requirement? Should a condition be placed on a LPAS license stating the requirement that users employing WMAS must meet that standard?

22. What are the costs and benefits of establishing a spectral efficiency requirement for WMAS devices? Is a higher efficiency requirement more difficult or expensive to meet, and does it limit wireless microphone operators' ability to make use of the spectrum? On the other hand, what are the costs of not establishing a spectrum efficiency requirement, or not taking other steps to ensure that WMAS would be used efficiently, with respect to white space device operations or other users' operations that share use of the same frequency bands that would be available for WMAS use? The Commission seeks any quantitative support regarding the answers to these questions.

23. Output Power. Under the current part 74 rules, wireless microphones in the TV bands are limited to 50 milliwatts equivalent isotropically radiated power (EIRP) in the VHF band, 250 milliwatts conducted power in the UHF band, 20 milliwatts EIRP in the duplex gap, 250 milliwatts conducted power in the 1435-1525 MHz band, and 1 watt conducted power in all other bands. These power limits apply to each individual wireless microphone, so that if, for example, there are 12 wireless microphones operating in close physical proximity within a single 6-megahertz channel, the total power within that channel will be 12 times greater than if there were a single wireless microphone. The Commission notes that, as a practical matter, wireless microphones generally operate at less than the maximum power the rules allow due to a number of considerations, such as the need to extend battery life, reduced interference between wireless microphones, and because the maximum power is simply not necessary in many applications.

24. Sennheiser did not request higher power for WMAS devices than the part 74 rules currently allow for wireless microphones. It states that WMAS devices would operate at a lower power spectral density (PSD) which allows for greater frequency re-use, thereby improving spectrum efficiency over a geographic region with heavy wireless microphone use. However, Shure argues that the Commission should clarify that the current part 74 power limits are limits per channel, and that WMAS

should be allowed to use PSD levels up to 750 milliwatts per megahertz in the UHF-TV band and most other bands available for wireless microphones under part 74. Shure argues that this PSD limit is equivalent to a single channel power limit of 250 milliwatts (i.e., three audio channels per megahertz).

25. Discussion. The Commission proposes to allow WMAS to operate at up to the same maximum power levels as other part 74 LPAS devices, but seeks comment on whether it should allow higher power levels as Shure suggests or make other changes to the power limits for WMAS. What is the appropriate maximum power level for each of the bands where WMAS would operate? Should the power limit be expressed in terms of PSD, absolute maximum power, or some combination of the two, and should they be conducted or radiated (EIRP) limits? Should the power be capped or permitted to scale with the number of audio channels being delivered? For example, should more power be permitted if a WMAS provides more channels than any minimum the Commission might specify? For example, if the Commission were to adopt its proposal to require at least three audio channels per megahertz, should the Commission permit more power for a device that provides four or more audio channels per megahertz? How does the power the Commission permits and/or the way it specifies it affect re-use distance between systems? Commenters should specify how whatever power limit it supports provides the ability to re-use WMAS in crowded areas (e.g., among the many theaters in New York's theater district). Should WMAS devices be required to incorporate transmit power control to limit power to the minimum necessary for a particular application? What are the costs and benefits of higher or lower power limits and a requirement to incorporate transmit power control? To the extent that the higher power levels are considered, as proposed by Shure, should they be permitted in particular bands or in all bands? For instance, should higher power be precluded from the 6875-6900 MHz and 7100-7125 MHz bands in light of recent changes to the 6 GHz band?

26. The Commission also seeks comment on the potential for WMAS to affect licensed broadcast services in the TV bands, other uses of the TV bands such as unlicensed white space devices, as well as other licensed and unlicensed operations where authorized in portions of the 900 MHz, 1.4 GHz, and 7 GHz bands. How would WMAS power levels and wider bandwidths affect the potential of these devices to cause harmful interference to broadcast services in the TV bands or to authorized services in other bands? Is WMAS more or less likely to affect broadcast services or other authorized services than

the wireless microphones currently permitted under part 74? Similarly, what impact would WMAS have on unlicensed white space devices that operate in the TV bands and in the upper 6-megahertz portion of the 600 MHz duplex gap? Would WMAS make it more difficult for white space devices to operate, or would the potentially greater spectral efficiency of WMAS have a positive effect on the availability of spectrum for white space devices by reducing the number of TV channels that wireless microphones would need to use in a given area? Could WMAS devices and currently authorized wireless microphones co-exist within the same channel? Or do they need to operate on distinct channels thereby potentially using more spectrum than is used today when only currently authorized microphones are used? How would the power limit affect such co-existence?

27. In addition, the Commission seeks comment on whether there is a need to modify the rules to resolve an inconsistency in the power limits for part 74 wireless microphones that operate in the TV bands. Section 74.861(e)(1) specifies the power limit for wireless microphones in the UHF-TV band in terms of conducted power, while the power limits for wireless microphones in the VHF-TV bands and the duplex gap are expressed in terms of EIRP. This difference stems from the 2015 *Wireless Microphone R&O* when the Commission changed the power limit for wireless microphones in the VHF-TV band from a conducted limit to an EIRP limit to make the VHF-TV band more usable by wireless microphones. However, the Commission did not address the power limit for wireless microphones in the UHF-TV band in that proceeding, leaving it unchanged as a conducted power limit (250 milliwatts). Should the Commission modify the power limit for part 74 wireless microphones in the UHF-TV band (470-608 MHz) from a conducted limit to an EIRP limit, consistent with rules for part 74 wireless microphones in the VHF-TV bands and part 15 wireless microphones in both the VHF and UHF-TV bands? What are the advantages and disadvantages of such a change? What would be the impact in terms of benefits and costs on manufacturers and users? How would such a change affect the interference potential of part 74 wireless microphones, either within or outside of the UHF-TV band? How would such a change affect existing, already approved microphones? Commenters should provide information regarding why any equipment or uses may need any accommodations, such as grandfathering, based on any advocated changes in this matter.

28. Emission Mask. Part 74 wireless microphones operating in the bands where the

Commission is proposing to allow WMAS operations are currently required to comply with emission masks associated with the 2011 version of ETSI EN 300 422-1 (2011), which the Commission adopted for wireless microphones under the part 74 LPAS rules in 2015. As discussed above, these emission masks limit wireless microphones to bandwidths of less than one megahertz and are therefore not suited to WMAS. An updated ETSI standard, EN 300 422-1 (2017), specifies an emission mask that is applicable to WMAS (as defined in the ETSI standard), and Shure suggests in a recent *ex parte* filing that the Commission incorporate that updated version into the Commission's rules. Shure also suggests that the Commission adopt a requirement that transmitter intermodulation distortion comply with limits in section 8.5.3 of EN 300 422-1 (2017) and that the Commission modify the existing part 74 wireless microphone rules to specify the transmit masks in this standard. Shure underscores that by updating the Commission's rules consistent with the ETSI standards for wireless microphones, including WMAS, the Commission would be harmonizing our rules and thereby benefit the wireless microphone community. Shure also notes that ETSI currently is in the process of further revising and updating the standards relating to WMAS, and Shure recommends that the Commission adopt the updated standards if ETSI adopts them.

29. Discussion. The Commission proposes to require WMAS devices to comply with the updated 2017 version of ETSI standard EN 300 422-1 (2017) concerning the transmit mask as suggested by Shure. This proposal is consistent with the current part 74 wireless microphone rules that require wireless microphones to comply with ETSI transmit emission masks (2011 version). The Commission proposes to require that WMAS emissions outside the band where the emission mask is defined comply with the spurious emission limits in Section 8.4 of ETSI EN 300 422-1 (2017). If ETSI updates its applicable standards for WMAS during the pendency of this rulemaking, the Commission requests comment on whether the Commission should instead adopt the later version instead of the 2017 version. In proposing to update its technical rules by adopting the 2017 ETSI standard relating to WMAS, the Commission seeks to achieve the additional benefits associated with harmonizing the Commission's rules with the latest technologies for wireless microphones.

30. The Commission seeks comment on its proposal and on the costs and benefits associated with it. Are the ETSI transmit emission masks for WMAS devices and the spurious emission limits



sufficient to protect authorized services in adjacent bands? Will they adequately protect broadcast TV and other authorized services? Will these emission limits allow for sharing spectrum between wireless microphone systems, both wider bandwidth WMAS and narrower bandwidth devices operating under the current LPAS rules? What impact would WMAS operating under these limits have on white space devices? Would different emission limits be more appropriate, and if so, which ones and why? What are the costs and benefits of requiring devices to meet the ETSI emission limits or any alternative limit suggested by commenters?

31. The Commission also seeks comment on whether there is a need to adopt the ETSI intermodulation distortion limits as suggested by Shure. Shure requests that the Commission make clear that combining multiple users on a single antenna is conceptually distinct from the applicable emissions mask, and suggests that transmitter intermodulation distortion comply with limits in EN 300 422-1 (2017). Is there a need for intermodulation distortion limits as Shure suggests? If so, are the ETSI limits appropriate or would some other limits be more appropriate? What are the costs and benefits of adopting ETSI or some other intermodulation distortion limits?

32. Other Considerations. The Commission also seeks comment on whether there are other technical issues that it should consider and address when establishing rules permitting use of WMAS for wireless microphone operations under the Commission's part 74 LPAS rules. If the Commission were to permit WMAS, it seeks comment on any technical issues that would facilitate the Commission's approval of these new devices under its certification procedures. For instance, are the measurement procedures in EN 300 422 (2017) sufficient for these devices? Are there any other industry standards applicable to the testing of WMAS devices?

33. Updating Technical Rules for Existing part 74 LPAS Wireless Microphones to Revised ETSI Standards. The existing technical rules for part 74 LPAS wireless microphones incorporated certain ETSI standards that date to 2011. These ETSI standards currently apply to each of the bands in which the Commission is proposing to authorize WMAS – specifically, the VHF-TV bands (54-72 MHz, 76-88 MHz and 174-216 MHz), the UHF-TV band (470-608 MHz), the 653-657 MHz segment of the 600 MHz duplex gap, and the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-

1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands. As Shure notes, these ETSI standards recently have been updated.

34. Discussion. The Commission takes this opportunity to propose updating the existing part 74 LPAS device rules to require the use of an updated ETSI standard that applies to those type of devices (i.e., non-WMAS wireless microphones). Specifically, the Commission proposes to update the existing part 74 wireless microphone rules to specify the transmit emission masks and spurious emission limits in EN 300 422-1 (2017) in place of the emission masks in the 2011 version of this standard which are currently specified in the rules. The Commission also proposes to slightly reorganize the rule sections specifying the emission masks and spurious emission limits to make them easier to follow, i.e., separate paragraphs specifying the mask for analog systems, the masks for digital systems, and the spurious emission limits outside the masks.

**Incorporation by reference:** The proposed standard specifies minimum performance requirements and methods of measurement for assistive listening devices, wireless microphones and in-ear monitoring systems and applies to equipment operating on radio frequencies up to 3 GHz using analog, digital and hybrid (using both analog and digital) modulation. This document is available at no charge from Harmonised European Standard at [https://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.01.02\\_60/en\\_30042201v020102p.pdf](https://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.01.02_60/en_30042201v020102p.pdf) and is thus reasonably available to interested parties.

35. While the spurious emission limits in the 2011 and 2017 versions of the ETSI standard are the same and the newer emission masks are very similar to the older ones, there is one significant difference in the masks for digital wireless microphones. Specifically, the 2011 standard defines the emission mask for digital systems over a frequency range from one megahertz below to one megahertz above the wireless microphone carrier frequency, whereas the newer 2017 standard defines the emission mask over a frequency range from  $5 \times B$  below to  $5 \times B$  above the carrier frequency, where  $B$  is the wireless microphone bandwidth in megahertz. This difference means that digital wireless microphones that comply with the newer emission masks could potentially operate with a wider bandwidth than those that comply with the older mask defined in the 2011 standard. The Commission recognizes that section 5.1 of ETSI 300 422-1 (both 2011 and 2017) specifies a maximum wireless microphone bandwidth of 200

kilohertz at frequencies below 1 GHz and 600 kilohertz at frequencies above 1 GHz, but the part 74 rules do not specify a bandwidth limit outside of the TV bands and duplex gap, and they do not require compliance with the ETSI bandwidth limits.

36. The Commission seeks comment on the proposal to apply the ETSI 2017 standard for emission masks and spurious emissions to the types of wireless microphones currently permitted under part 74. Should the Commission update the rules to require using the transmit emission masks and spurious emission limits in ETSI EN 300 422-1 (2017)? What are the advantages or disadvantages of the modified frequency range of the masks for digital systems? Would it provide manufacturers any additional flexibility? Would it affect how efficiently users could use the spectrum? Is there any need to limit the digital system emission masks to a frequency range to +/- 1 MHz from the carrier frequency as the current rules require? The Commission also seeks comment on any updates to the ETSI standard that are currently in progress. When is a new version expected to be available, and how does it differ from the 2017 version? Finally, for commenters who support updating the rules for microphones currently permitted under part 74 to the newer 2017 ETSI standard, the Commission seeks comment on whether to also adopt an appropriate timeframe to transition to the newer requirements and discontinue certifying equipment under the 2011 standard's emission mask and spurious emissions requirements. The Commission is mindful that any new planned wireless microphone model roll-outs not be disrupted, but also seek to update the rules as expeditiously as possible to garner the benefits they would provide. What impact would imposing the updated emission masks and spurious emission limits from the 2017 standard have on the ability to certify existing equipment? Would equipment being developed to comply with the existing rules also comply with updated rules consistent with the 2017 standard? Or, if a transition period is needed, is 6 months or 1 year a reasonable timeframe to alter the equipment approval process and phase out the rules adopted consistent with the 2011 standard to not impede existing equipment developments?

37. Revisions to the Technical Rules for part 15 Unlicensed Wireless Microphone Operations in the TV Bands, the 600 MHz Guard Band, and the 600 MHz Duplex Gap. The Commission notes that Sennheiser and other wireless microphone manufacturers did not request that WMAS operations be permitted under the part 15 rules for unlicensed wireless microphone operations in the TV bands, the 600 MHz guard band, or the 600 MHz duplex gap. The Commission also notes that Microsoft expresses

concerns about permitting WMAS in these bands. Given, however, that the Commission's rules permit wireless microphones to operate on an unlicensed basis under part 15 of the rules in the VHF-TV bands (54-72 MHz, 76-88 MHz and 174-216 MHz), the UHF-TV band (470-608 MHz), the 614-616 MHz segment of the 600 MHz guard band, and the 657-663 MHz segment of the 600 MHz duplex gap, that the rules currently provide that unlicensed wireless microphones in these bands must comply with emission masks and spurious emission limits defined in the 2011 version of the ETSI standard for wireless microphones, that wireless microphones in these bands often historically have used the same underlying technologies regardless of whether they operate on a licensed basis under part 74 or an unlicensed basis under part 15, and that oftentimes the same users may operate both licensed and unlicensed wireless microphones, the Commission seeks comment on the extent to which update the applicable rules for these devices to be consistent with the most recent ETSI standard as it is proposing for licensed LPAS wireless microphones, and whether the Commission should otherwise permit use of WMAS for unlicensed wireless microphones in any of these bands.

38. Background. The Commission generally applies the same technical rules to unlicensed and licensed wireless microphones operations in the TV bands and the 600 MHz duplex gap, with certain differences relating to operation. In the TV bands, the technical requirements applicable to unlicensed wireless microphones are the same as those under part 74, while the maximum permissible power for unlicensed wireless microphones in the UHF-TV band is lower (i.e., 50 milliwatts) than permitted for licensed LPAS wireless microphone operations (i.e., 250 milliwatts) in that band. The rules for operation the 600 MHz duplex gap (652-663 MHz) differ between unlicensed wireless microphone and licensed part 74 LPAS wireless microphone operations in that licensed LPAS wireless microphones may operate in a 4-megahertz portion (653-657 MHz), while unlicensed wireless microphones may operate in a separate 6-megahertz portion (657-663 MHz), both limited to 20 milliwatts EIRP. Unlicensed wireless microphones share this 6-megahertz portion of the 600 MHz duplex gap with unlicensed white space devices, which operate under other part 15 rules. The emission mask and the spurious emission limits that apply to unlicensed wireless microphones in the TV bands and the 600 MHz guard band and duplex gap are the same as those that apply to licensed LPAS devices.

39. Microsoft asks that the Commission prohibit WMAS use by unlicensed wireless microphone operators in the TV bands and the 600 MHz duplex gap if such operations would be inconsistent with other existing part 15 technical rules. It notes that the current rules governing unlicensed wireless microphones allow such devices to operate with a higher spectral density than part 15 white space devices. Microsoft expresses concern that permitting 6-megahertz WMAS systems for unlicensed wireless microphones could “break this careful balance and allow co-channel operation with [w]hite [s]pace devices at significantly higher power levels than the FCC intended.” It asserts that the 6-megahertz channel in the 600 MHz duplex gap is especially critical for white space device operations because that is the only channel available for white space device operations throughout the entire United States.

40. Discussion. Consistent with its proposals to update the emission masks and spurious emission limits in the existing part 74 LPAS rules for licensed wireless microphones (i.e., wireless microphones that are limited to 200 kHz channels), the Commission similarly proposes to update the part 15 rules to specify the transmit emission masks and the spurious emission limits in EN 300 422-1 (2017) in place of the emission masks and spurious emission limits in the 2011 version of this standard which are currently specified in the rules. While the newer masks are very similar to the older ones, there is one significant difference in the masks for digital wireless microphones. Specifically, the older masks for digital systems were defined over a frequency range from one megahertz below to one megahertz above the wireless microphone carrier frequency, whereas the newer masks are defined over a frequency range from  $5 \times B$  below to  $5 \times B$  above the carrier frequency, where  $B$  is the wireless microphone bandwidth in megahertz.

41. The Commission seeks comment on this proposal. Should the Commission update the rules to require the use of the transmit emission masks in ETSI EN 300 422-1 (2017)? What are the advantages or disadvantages of the modified frequency range of the masks for digital systems? Would it provide manufacturers any additional flexibility? Would it affect the efficiency of spectrum use? Is there any need to limit the digital system emission masks to a frequency range to  $\pm 1$  MHz from the carrier frequency as the current rules require? The Commission also seeks comment on any updates to the ETSI standard that are currently in progress. When is a new version expected to be available, and how does it

differ from the 2017 version? How would updating the rules to harmonize with the ETSI standard create or hinder opportunities for wireless microphone manufacturers? What are the ramifications on the ability to easily manufacture and sell these products on a global scale?

42. While the Commission notes that Sennheiser and other wireless microphone manufacturers did not request that WMAS operations be permitted for unlicensed wireless microphone operations in the TV bands, 600 MHz guard band, or the 600 MHz duplex gap, and that Microsoft opposed permitting WMAS in the unlicensed portion of the 600 MHz duplex gap, the Commission nonetheless seeks comment on whether WMAS should be permitted for unlicensed wireless microphone operations in any of these bands, and, if so, any technical rules or restrictions that should apply. The Commission recognizes that there are unlicensed entities that operate wireless microphones in UHF bands that have a need to operate a large number of wireless microphones, but do not fall into any of the categories of entities eligible for a license under part 74 of the rules, and thus must operate wireless microphones on an unlicensed basis in the TV bands, the 600 MHz guard band, and the unlicensed portion of the 600 MHz duplex gap.

43. If the Commission were to allow WMAS under part 15 of the rules, in which bands should they be permitted to operate? Should they be allowed in only the TV bands, or also in the 600 MHz guard band, where unlicensed wireless microphones are permitted, and in the unlicensed upper 6-megahertz portion of the duplex gap (657-663 MHz)? Alternatively, should the Commission allow WMAS in the TV bands and the 600 MHz guard band, but not in the unlicensed portion of the 600 MHz duplex gap given the concerns raised by Microsoft? If the Commission were to allow such operation, what technical requirements should apply? Specifically, should they be permitted to operate with the current power limits of 50 milliwatts EIRP in the TV bands and 20 milliwatts EIRP in the 600 MHz guard band and 600 MHz duplex gap? Should the same bandwidth and spectral efficiency requirements apply as the Commission proposed for licensed WMAS? Would the ETSI emission masks and spurious emission limits that the Commission proposes for part 74 licensed WMAS devices be suitable for unlicensed WMAS devices?

44. The Commission does not intend to take any action in this proceeding that would constrain spectrum availability for or otherwise adversely impact the use of this spectrum for white space

device operations. Accordingly, the Commission also seeks comment on the impact of permitting WMAS operations, both licensed and unlicensed, on part 15 white space devices which can operate in the VHF and UHF-TV bands and in the upper segment (657-663 MHz) of the 600 MHz duplex gap. White space devices must share spectrum with unlicensed wireless microphones on an equal basis but may not operate on channels at locations and at times that have been registered in the white space database for use by licensed wireless microphones. Would the rules the Commission is proposing for part 74 WMAS negatively impact white space devices in any way? Could the higher spectral efficiency of WMAS devices actually improve the availability of spectrum for white space devices since the same number of licensed wireless microphones could potentially operate in fewer channels?

45. Finally, for commenters who support updating the rules for part 15 unlicensed wireless microphones to the newer 2017 ETSI standard, the Commission seeks comment on whether to also adopt an appropriate timeframe to transition to the newer requirements and discontinue certifying equipment under the 2011 standard's emission mask and spurious emissions requirements. What impact would imposing the updated emission masks and spurious emission limits from the 2017 standard have on the ability to certify existing equipment? Would equipment being developed to comply with the existing rules also comply with updated rules consistent with the 2017 standard? Or, if a transition period is needed, is 6 months or 1 year a reasonable timeframe to alter the equipment approval process and phase out the rules adopted consistent with the 2011 standard to not impede existing equipment developments?

46. Similarly, the Commission seeks comment on whether allowing part 15 unlicensed WMAS devices would have any negative impact on white space operations, or whether that could improve the availability of channels for white space devices due to the higher spectral efficiency of WMAS devices? In particular, the Commission seeks comment on whether allowing unlicensed WMAS devices to operate in the upper 6-megahertz segment of the 600 MHz duplex gap would be a problem for white space devices as Microsoft suggests? Under the current rules, unlicensed wireless microphones may operate in the duplex gap with a power level of up to 20 milliwatts EIRP. Because unlicensed wireless microphones have a bandwidth limit of 200 kilohertz, multiple unlicensed wireless microphones can operate in the duplex gap simultaneously, resulting in a total radiated power level of well over 20 milliwatts in the 6-megahertz band where they operate. Could WMAS permit the operation of multi-

channel wireless microphones in the duplex gap at lower total power or power spectral density levels than the current rules permit, and thus reduce the likelihood of interference to white space devices? Are there other factors that could affect the coexistence of unlicensed wireless microphones and white space devices in the duplex gap or the TV bands?

47. Updating Wireless Microphone Rules Following the End of the Post-Incentive Auction Transition. Wireless microphones, both licensed and unlicensed, were previously permitted to operate in the 600 MHz band (former TV channels 38-51) that was reallocated for wireless services in the *Incentive Auction R&O*. In that action, the Commission established a 39-month period during which TV stations would transition out of the 600 MHz band, and decided that wireless microphones would no longer be able to operate in the 600 MHz service band after this transition period, although they could still operate in the 600 MHz guard band(s) and 600 MHz duplex gap. In 2015 and 2017, the Commission established rules for both licensed and unlicensed wireless microphones that operate in the 600 MHz service band, certain segments of the 600 MHz guard band(s) and 600 MHz duplex gap, as well as transition requirements to implement the Commission's decision that all wireless microphones must cease operation in the 600 MHz service band at the end of the 39-month transition period. After the end of the transition period on July 13, 2020, wireless microphone operations in the 600 MHz band are limited to segments of the 600 MHz guard band and 600 MHz duplex gap as specified in the part 15 and 74 rules.

48. The Commission proposes to modify the part 74 and part 15 rules to reflect the end of the 39-month transition period. Some of these changes are not substantive and simply implement previous Commission decisions. Because the Commission is proposing to amend the part 74 and part 15 wireless microphone rules to allow WMAS and update references to ETSI standards, the Commission is including these additional changes in the proposed rules. The Commission seeks comment on whether these proposed changes are appropriate and whether there are any other rules not included in the proposed rules that also should be updated to reflect the end of the transition period.

49. Part 74. The Commission proposes to modify the list of frequencies in § 74.802(a) that are available for low power auxiliary stations by removing the 614-698 MHz band (former TV channels 38 to 51) and replacing it with the 653-657 MHz band (a segment of the 600 MHz duplex gap), which is the only portion of the 600 MHz band now available under part 74. The Commission also proposes to



modify the technical requirements in § 74.861(e)(1) to remove the reference to the 614-698 MHz band in paragraph (ii) and to add the frequency band for the segment of the duplex gap where wireless microphones can operate in paragraph (iii). The Commission also notes that a number of part 74 rules specify deadlines related to the post-Incentive Auction transition or other rule changes that have since passed. For example, §§ 74.802(f) and 74.851(i) through (l) contain provisions related to the now ended 600 MHz band transition. Section 74.870(c) lists 600 MHz band frequencies for Wireless Video Assist devices that are no longer available after the end of the transition, and §§ 74.861(d)(3), (e)(6) and 74.870(i) contain transition dates that have passed. The Commission seeks comment on its proposals to modify these rules as well as whether there are any other part 74 rules that can be removed or modified.

50. Part 15. The Commission proposes to make certain edits to the part 15 rules to remove unnecessary references to transition dates that have passed and to make the rules clearer and easier to follow. Specifically, with regard to § 15.236, the Commission proposes to amend paragraph (a) to remove the definition of 600 MHz service band since it is no longer available for wireless microphone use, as well as the definition of Spectrum Act, since it is not referenced anywhere else in this rule section. The Commission also proposes to remove paragraph (c)(2) which lists the 600 MHz service band as being available for unlicensed wireless microphones and paragraph (e)(2) which lists minimum required separation distances from 600 MHz service band licensees, as well as modify paragraph (d)(1) to remove a reference to the 600 MHz service band. The Commission further proposes to remove section 15.236(c)(6) which requires that prior to operation in 600 MHz service band, 600 MHz guard band(s) or 600 MHz duplex gap, wireless microphone users must rely on the white space database to determine that their intended operating frequencies are available for unlicensed wireless microphone operation at the location where they will be used, and to make corresponding revisions to the white space rules to reflect the removal of this section. This requirement appears unnecessary after the end of the post-incentive auction transition since with the removal of all TV stations from the 600 MHz band, there are no licensed services to protect in either the 600 MHz guard band or the upper 6-megahertz portion of the 600 MHz duplex gap. The Commission also proposes to remove § 15.37(i) (transition provisions for compliance with modified wireless microphone rules) since the certification, manufacturing, marketing and operational cutoff dates have all passed and there does not appear to be a need to retain this section. The

Commission further proposes to remove § 15.37(k) (disclosure requirements for unlicensed wireless microphones capable of operating in the 600 MHz service band) since all marketing of unlicensed wireless microphones that operate in the 600 MHz service band is now prohibited, so there does not appear to be a need for this rule on consumer disclosure.

51. The Commission seeks comment on these proposals. Does the Commission need to retain any of the rules that it proposes to eliminate? Is there a need for a rule specifically prohibiting unlicensed wireless microphone operation in the 600 MHz service band, or is it sufficient to simply remove all rules related to operation in this band, thus indirectly indicating that such operation is prohibited? With regard to the proposed removal of § 15.236(c)(6), the Commission notes that the Spectrum Act states that operation of unlicensed devices in the 600 MHz guard bands “shall rely on a database or subsequent methodology as determined by the Commission.” While the Commission is proposing to remove the database access requirement for unlicensed wireless microphones operating in the guard bands (including duplex gap) as no longer necessary, it believes the fact that these bands are now unavailable to licensed services nationwide constitutes a subsequent methodology that will ensure unlicensed wireless microphones do not cause harmful interference to licensed services, thus complying with the requirements of the Spectrum Act. The Commission seeks comment on this assessment.

## **PROCEDURAL MATTERS**

52. Paperwork Reduction Act Analysis. This document does not contain proposed information collection(s) subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified information collection burden for small business concerns with fewer than 25 employees, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4).

53. Initial Regulatory Flexibility Analysis. As required by the Regulatory Flexibility Act, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities of the proposals addressed in this document. The IRFA is found in Appendix C at <https://www.fcc.gov/document/fcc-looks-open-door-new-wireless-microphone-technologies-0>. The commission requests written public comment on the IRFA. Comments must be filed in accordance with the same filing deadlines as comments filed in response to the Notice of

Proposed Rulemaking and must have a separate and distinct heading designating them as responses to the IRFA. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this document, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration, in accordance with the Regulatory Flexibility Act.

54. Ex Parte Presentations. This proceeding is a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules. Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda, or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

55. Filing requirements. Pursuant to §§ 1.415 and 1.419 of the Commission's rules, 47 CFR 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing

the ECFS: <http://www.fcc.gov/ecfs/>.

- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.
- Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street NE Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. See FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy, Public Notice, 35 FCC Rcd 2788, 2788-89 (OS 2020). <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.

56. People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

57. Additional Information. For additional information on this proceeding, contact Hugh L. Van Tuyl, [Hugh.VanTuyl@fcc.gov](mailto:Hugh.VanTuyl@fcc.gov), (202) 418-7506.

## **ORDERING CLAUSES**

58. IT IS ORDERED, pursuant to the authority found in Sections 4(i), 301, 302, and 303 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 201, 302a, 303, and §§ 1.407 and 1.411

of the Commission's Rules, 47 CFR 1.407 and 1.411, that this *Notice of Proposed Rulemaking* IS HEREBY ADOPTED. The petition for rulemaking of Sennheiser Electronic Corporation, RM-11821, is hereby GRANTED to the extent discussed herein, and shall be consolidated into ET Docket No. 21-115.

59. IT IS FURTHER ORDERED that NOTICE IS HEREBY GIVEN of the proposed regulatory changes described in this *Notice of Proposed Rulemaking*, and that comment is sought on these proposals.

60. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this *Notice of Proposed Rulemaking*, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

#### **List of Subjects**

##### **47 CFR Part 15**

Communication equipment, Computer technology, Incorporation by reference, Labeling, Reporting and recordkeeping requirements.

##### **47 CFR Part 74**

Communications equipment, Reporting and recordkeeping requirements.

FEDERAL COMMUNICATIONS COMMISSION

Marlene Dortch,  
Secretary.

## Proposed Rules

The Federal Communications Commission proposes to amend 47 CFR parts 15 and 74 as follows:

### PART 15—RADIO FREQUENCY DEVICES

1. The authority citation for part 15 continues to read as follows:

**AUTHORITY:** 47 U.S.C. 154, 302a, 303, 304, 307, 336, 544a, and 549.

#### § 15.37 [Amended]

2. Remove and reserve paragraphs (i) and (k).
3. Amend § 15.38 by revising paragraphs (a) and (e) to read as follows:

#### § 15.38 Incorporation by reference.

(a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. All approved material is available for inspection at the Federal Communications Commission's Reference Information Center, located at the address of the FCC's main office indicated in 47 CFR 0.401(a), Tel: (202) 418-0270, and is available from the sources listed elsewhere in this section. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email [fedreg.legal@nara.gov](mailto:fedreg.legal@nara.gov) or go to [www.archives.gov/federal-register/cfr/ibr-locations.html](http://www.archives.gov/federal-register/cfr/ibr-locations.html).

\* \* \* \* \*

(e) The European Telecommunications Standards Institute (ETSI), 650 Route des Lucioles, F-06921 Sophia Antipolis Cedex, France, <https://www.etsi.org>.

(1) ETSI EN 300 422-1 V2.1.2 (2017-01): “*Wireless Microphones; Audio PMSE up to 3 GHz; part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU*” Copyright 2017

([https://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.01.02\\_60/en\\_30042201v020102p.pdf](https://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.01.02_60/en_30042201v020102p.pdf))  
)IBR approved for § 15.236(g).

(2) [Reserved]

\* \* \* \* \*

4. Amend § 15.236 by revising the section heading and paragraphs (a), (c), (d)(1), (e) and (g) to read as follows:

**§ 15.236 Operation of wireless microphones in the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, 614-616 MHz and 657-663 MHz.**

(a) *Definitions.* The following definitions apply in this section.

(1) *Wireless Microphone.* An intentional radiator that converts sound into electrical audio signals that are transmitted using radio signals to a receiver which converts the radio signals back into audio signals that are sent through a sound recording or amplifying system. Wireless microphones may be used for cue and control communications and synchronization of TV camera signals as defined in §74.801 of this chapter. Wireless microphones do not include auditory assistance devices as defined in §15.3(a).

(2) *600 MHz duplex gap.* An 11 megahertz guard band at 652-663 MHz that separates part 27 600 MHz service uplink and downlink frequencies.

(3) *600 MHz guard band.* Designated frequency band at 614-617 MHz that prevents interference between licensed services in the 600 MHz service band and channel 37.

\* \* \* \* \*

(c) Operation is permitted in the following frequency bands.

(1) Channels allocated and assigned for the broadcast television service.

(2) The 657-663 MHz segment of the 600 MHz duplex gap.

(3) The 614-616 MHz segment of the 600 MHz guard band.

(d) \* \* \*

(1) In the bands allocated and assigned for broadcast television: 50 mW EIRP.

\* \* \* \* \*

(e) Operation is limited to locations at least four kilometers outside the following protected service contours of co-channel TV stations:

| Type of station  | Protected contour |               |                   |
|--|-------------------|---------------|-------------------|
|  | Channel           | Contour (dBu) | Propagation curve |
| Analog: Class A TV, LPTV, translator and booster                   | Low VHF (2-6)     | 47            | F(50,50)          |
|  | High VHF (7-13)   | 56            | F(50,50)          |
|  | UHF (14-51)       | 64            | F(50,50)          |
| Digital: Full service TV, Class A TV, LPTV, translator and booster | Low VHF (2-6)     | 28            | F(50,90)          |
|  | High VHF (7-13)   | 36            | F(50,90)          |
|  | UHF (14-51)       | 41            | F(50,90)          |

\* \* \* \* \*

(g)(1) *Analog systems.* Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2 of ETSI EN 300 422-1 (incorporated by reference, see § 15.38).

(2) *Digital systems.* Emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.3 of ETSI EN 300 422-1 (incorporated by reference, see § 15.38).

(3) *Spurious emission limits for analog and digital systems.* Emissions outside of the bands listed in paragraphs (g)(1) and (2) of this section shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 (incorporated by reference, see § 15.38).

5. Amend § 15.703 by revising the definition of “White space database” to read as follows:

#### **§ 15.703 Definitions.**

\* \* \* \* \*

*White space database.* A database system approved by the Commission that maintains records on authorized services and provides lists of available channels to white space devices.



6. Amend § 15.713 by removing and reserving paragraph (a)(2), revising paragraph (a)(3) and removing and reserving paragraphs (f) and (i) to read as follows:

**§ 15.703 White space database.**

(a) \* \* \*

(2) [Reserved]

(3) To register the identification information and location of fixed white space devices.

\* \* \* \* \*

(f) [Reserved]

\* \* \* \* \*

(i) [Reserved]

\* \* \* \* \*

**§ 15.715 [Amended]**

7. Amend § 15.715 by removing paragraph (q).

**PART 74—EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER  
PROGRAM DISTRIBUTION SERVICES**

8. The authority citation for part 74 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 307, 309, 310, 336 and 554.

9. Amend § 74.801 by adding a definition for “Wireless Multi-Channel Audio System” to read as follows:

**§ 74.801 Definitions**

\* \* \* \* \*

*Wireless Multi-Channel Audio System.* A system that digitally combines the signals of multiple

low power auxiliary station devices onto one radio-frequency channel.

10. Amend § 74.802 by revising paragraph (a) to read as follows:

**§ 74.802 Frequency assignment.**

(a) Frequencies within the following bands may be assigned for use by low power auxiliary stations:

26.100-26.480 MHz

54.000-72.000 MHz

76.000-88.000 MHz

161.625-161.775 MHz (except in Puerto Rico or the Virgin Islands)

174.000-216.000 MHz

450.000-451.000 MHz

455.000-456.000 MHz

470.000-488.000 MHz

488.000-494.000 MHz (except Hawaii)

494.000-608.000 MHz

653.000-657.000 MHz

941.500-944.000 MHz

944.000-952.000 MHz

952.850-956.250 MHz

956.45-959.85 MHz

1435-1525 MHz

6875.000-6900.000 MHz

7100.000-7125.000 MHz

\* \* \* \* \*

11. Amend § 74.861 by revising paragraphs (d)(4), (e)(1), (5) and (7), the introductory text to paragraph (i) and paragraph (i)(1) to read as follows:

**§ 74.861 Technical requirements.**

\* \* \* \* \*

(d)\* \* \*

(4)(i) *Analog systems.* For the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2 of ETSI EN 300 422-1.

(ii) *Digital systems.* For the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.3 (Figure 4 below 2 GHz or Figure 5 above 2 GHz) of ETSI EN 300 422-1.

(iii) *Wireless Multi-Channel Audio Systems.* For the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.4 of ETSI EN 300 422-1. The operating bandwidth (B) may not exceed 6 megahertz, and the device must transmit at least three audio channels per megahertz.

(iv) *Spurious emission limits.* Emissions outside of the emission masks specified in paragraphs (d)(4)(i) through (iii) shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1.

(e) \* \* \*

(1) The power may not exceed the following values.

(i) 54-72, 76-88, and 174-216 MHz bands: 50 mW EIRP

(ii) 470-608 MHz band: 250 mW conducted power

(iii) 653-657 MHz band: 20 mW EIRP

\* \* \* \* \*

(5) The operating bandwidth shall not exceed 200 kilohertz, except that a wireless multi-channel audio system may have an operating bandwidth not exceeding 6 megahertz and must transmit at least three audio channels per megahertz. For wireless multi-channel audio system devices operating in the TV bands, the 6 megahertz (or less) channel must fall entirely within a single TV channel (2-36) that is available for part 74 LPAS use under §74.802(b). The provisions of §74.802(c) regarding frequency of operation within TV channels do not apply to wireless multi-channel audio systems.

\* \* \* \* \*

(7)(i) *Analog systems.* Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2 of ETSI EN 300 422-1 .

(ii) *Digital systems.* Emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.3 of ETSI EN 300 422-1.

(iii) *Wireless Multi-Channel Audio Systems.* Emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.4 of ETSI EN 300 422-1 V2.1.2 (2017-01).

(iv) *Spurious emission limits.* Emissions outside of the bands listed in paragraphs (e)(7)(i) through (iii) shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1.

\* \* \* \* \*

(i) The standards required in this section are incorporated by reference into this section with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. All approved material is available for inspection at the Federal Communications Commission's Reference Information Center, located at the address of the FCC's main office indicated in 47 CFR 0.401(a), Tel: (202) 418-0270, and is available from the sources in this paragraph (i) For information on the availability of this material at

NARA, email [fedreg.legal@nara.gov](mailto:fedreg.legal@nara.gov) or go to [www.archives.gov/federal-register/cfr/ibrlocations.html](http://www.archives.gov/federal-register/cfr/ibrlocations.html).

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(i) ETSI EN 300 422-1 V2.1.2 (2017-01): “*Wireless Microphones; Audio PMSE up to 3 GHz; part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU*” Copyright 2017

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(ii) [Reserved]

(2) [Reserved]

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